Ecology Review Comments

East Waterway Operable Unit
Supplemental Remedial Investigation/Feasibility Study
Draft Final Feasibility Study
(October 2016)

The Washington State Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS) are applicable or relevant and appropriate requirements (ARARs) for the East Waterway (EW) Operable Unit (OU) cleanup under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and therefore remedial actions must achieve MTCA and SMS requirements or be formally waived.

Ecology conducted a review of the East Waterway Operable Unit – Draft Final Feasibility Study (Anchor QEA and Windward 2016a) with a specific focus on evaluating compliance with SMS. Upon inspection of the Feasibility Study (FS) Comment Responses (Anchor QEA and Windward 2016b), it was evident that the current draft of the FS has been significantly revised based on comments provided by the U.S. Environmental Protection Agency (EPA) and subsequent discussions during a series of comment resolution meetings. Therefore, this review provides a limited list of specific comments regarding the detailed content of the FS. The general comments provided below primarily address:

- Proposed remedial alternative compliance with SMS requirements;
- Consistency with Lower Duwamish Waterway (LDW) remedial activities; and
- MTCA disproportionate cost analysis (DCA) of alternatives.

Comments on specific sections of the FS are provided after the general comments.

1.0 GENERAL COMMENTS

1.1 Remedial Alternative Compliance with SMS

<u>Development of SMS Sediment Cleanup Levels</u>

The SMS term "sediment cleanup level (SCL)" is analogous to the CERCLA term "preliminary remediation goal (PRG)". The PRGs are used in the FS to guide evaluation of proposed remedial alternatives, but they are not the final CERCLA cleanup levels. The PRGs are informative for the development of the remedial action levels EPA will ultimately select in the Record of Decision (ROD). PRGs were developed in the FS to be consistent with SMS for the following remedial action objectives (RAOs):

- RAO 1: Human Health Seafood Consumption
- RAO 2: Human Health Direct Contact
- RAO 3: Benthic Invertebrates
- RAO 4: Higher Trophic Level Species

Under the SMS, SCLs may be established on a site-specific basis within an allowable range of contaminant concentrations. The low end of the range is the sediment cleanup objective (SCO), and the high end of the range is the cleanup screening level (CSL). The SCL may be adjusted upward from the SCO based on consideration of whether it is technically possible to achieve the SCO at the applicable point of compliance and whether meeting the SCO will have a net adverse environmental effect on the aquatic environment, natural resources, and habitat. The SCL may not be adjusted upward above the CSL. The SCO is the higher of the risk-based level (1x10-6), practical quantitation limit (PQL), and natural background. The CSL is the higher of the risk-based level (1x10-5), PQL, and regional background.

PRGs were developed to be consistent with the rules for cleanup level determination in SMS, but without considering regional background. Complete development of SMS SCLs would require the Washington State Department of Ecology (Ecology) to establish regional background values specific to the EW. To date Ecology has developed regional background values for Port Gardner Bay, Bellingham Bay, and the North Olympic Peninsula region. EPA's stated position is that, "it is premature to use regional background data to develop background based cleanup goals for the EW due to the current lack of specific guidance from Ecology on how to develop and apply such values (Anchor QEA and Windward 2016b)".

Without the establishment of EW regional background values, the CSL defaults to the higher of the risk-based concentration (1x10-5), PQL, and natural background. Cleanup levels to address RAO 1 must be met on a spatially-weighted average concentration (SWAC) basis. Current CSLs pertinent in the FS for RAO 1 are:

- Total polychlorinated biphenyls (PCBs) = 3.5 μg/kg (Ecology's natural background value based on 90/90 upper tolerance limit)
- Dioxins/furans = 5.0 ng TEQ/kg (Ecology's PQL)

<u>Development of Remedial Action Levels (RALs)</u>

RALs are contaminant-specific sediment concentrations that trigger the need for remediation, and are designed to achieve the SCLs or PRGs. SMS benthic numerical criteria that are applied on a point-by-point basis (PRGs for RAO 3) can be directly translated into RALs, while PRGs based on site-wide averaging cannot. Therefore remediation areas were developed in a stepwise manner by:

- First addressing RAO 3 by setting RALs for individual contaminants at the SMS benthic numerical SCO criteria (e.g., 12 mg/kg OC for total PCBs). The remediation area associated with meeting RAO 3 RALs constitutes 120 acres (76%) of the EW OU.
- Increasing the size of the remediation area by setting the dioxin/furan RAL at 25 ng TEQ/kg for consistency with the LDW ROD (EPA 2014). This increases the remediation area to 121 acres (77% of EW OU). The total remediation area is expected to decrease the surface sediment dioxin/furan SWAC to the RAO 1 SMS SCL of 5 ng TEQ/kg (see FS Table 6-1).
- Making progress toward lowering the site-wide PCB SWAC. Evaluations in the FS indicate that the SMS SCL for PCBs cannot be achieved in the EW regardless of the RAL chosen (see discussion the following section). Therefore, in addition to evaluating the PCB RAL at the RAO 3 PRG (12 mg/kg OC), a PCB RAL of 7.5 mg/kg OC was also evaluated because it is the lowest RAL that results in a decrease in the PCB SWAC (see FS Figure 6-2). Using a PCB RAL of 7.5 mg/kg OC increases the remediation area to 132 acres (84% of the EW OU).

- Finally, because carcinogenic polycyclic aromatic hydrocarbons (cPAH) are a risk driver for human health direct contact exposure, a cPAH RAL was needed to reduce the SWAC within potential clamming areas. A cPAH RAL of 660 μg TEQ/kg results in an additional remediation area of 3.3 acres of exposed intertidal area.

Attaining CERCLA compliance with SMS

The FS provides a variety of remedial action alternatives based on the RALs developed. All of the FS remedial action alternatives achieve SMS-based PRGs for protectiveness of human health for direct contact (RAO 2), protection of the benthic community (RAO 3), and protection of higher trophic level organisms (RAO 4) either immediately following active remediation or following remedial activities plus a period of natural recovery (see FS Table 6-1). However, none of the proposed remedial alternatives are expected to comply with the SMS SCL for PCBs for RAO 1 (based on natural background) (Total PCBs = 3.5 μg/kg). Factors other than the PCB RAL have a larger influence on the PCB SWAC, preventing remedial alternatives from achieving the SMS SCL:

- High PCB concentrations associated with EW lateral loadings, incoming Green/Duwamish River loadings, and re-suspended sediment from scour events within the LDW (see FS Table 5-5).
- Constructability constraints within the EW (e.g., overwater structures, bridges, etc.) which affect site-wide concentrations that can be achieved following cleanup.

Despite the post-construction surface sediment SWAC for PCBs not being expected to meet the SMS SCL based on the assumptions provided in the FS, CERCLA compliance with SMS has the potential to be attained through:

- **Increasing SMS CSLs based on regional background:** SMS SCLs could be adjusted upward to regional background-based CSLs once Ecology has established regional background levels for the EW. Such an adjustment of cleanup levels could occur before remediation is prescribed in the ROD, or after remediation as a ROD amendment of Explanation of Significant Difference (ESD).
- **Demonstrating SMS compliance during post-remedy monitoring:** SMS SCLs may be attained if lower than predicted sediment concentrations are observed during post-remedy monitoring. Such a demonstration would be an indication that assumptions used for recovery modeling in the FS were too conservative.
- **Establishing sediment recovery zones (SRZs):** SMS requires the establishment and monitoring of SRZs if cleanup actions do not achieve SMS SCLs within 10 years after completion of construction of the active components of the cleanup action. SRZs are used to track cleanup areas that remain above cleanup levels and perform additional cleanup or source control actions as necessary. Ecology has not established a SRZ since SMS was revised 2013. While Ecology's monitoring requirements for SRZs are not explicitly defined in Ecology (2015), the FS implies that Harbor Island Superfund Site 5-year reviews and site-wide monitoring program would provide the periodic review process for adjusting, eliminating, or renewing SRZs that are compliant with SMS.
- **EPA waiving SMS ARARs on the basis of technical impracticability (TI):** Following remediation and long-term monitoring, if EPA determines that no additional practicable

actions can be implemented under CERCLA to meet SMS criteria, EPA may issue a ROD Amendment or ESD providing the basis for a TI waiver for specific SMS ARARs.

1.2 Consistency with LDW Remedial Activities

The RAOs between the EW and LDW studies are the same as those listed in Section 2.1. In general, the PRGs and RALs were similar between these studies. However, a few differences are present. All values are presented in Table 1. The following discussion of Table 1 is broken down by RAO and COC. Key findings from each comparison are italicized.

RAO 1 for PCBs: RAO 1 represents the COCs that are human health risk drivers. In both the EW and LDW, the PRGs for PCBs are in dry weight, and organic carbon normalized for the RALs. The PRG for the LDW is 2 ug/kg and is based on a natural background calculated using the 95UCL. The PRG for the EW includes a second natural background option of 3.5 ug/kg using the 90/90UTL metric that was proposed in SCUM II. For simplicity, one natural background value should be selected moving forward. The RAL for PCBs in both studies was 12 mg/kg OC, consistent with the benthic SQS value. A lower RAL of 7.5 mg/kg OC was also selected for the EW for evaluation purposes.

RAO 1 for dioxins: The PRG for the LDW was 2 ng TEQ/kg based on natural background calculated using the 95UCL. This value is the higher of natural background and the human health RBTC for the LDW. The SMS rule revision and SCUM II introduced a new value, the PQL, to this comparison. For the EW, the PQL of 5 ng TEQ/kg is the highest value and therefore represents the PRG. The RAL of 25 ng TEQ/kg is consistent between the EW and LDW. This RAL is expected to result in a SWAC of 5 ng TEQ/kg after the remedy. Staying consistent with SCUM II and using a PRG set to the PQL ensures the dioxin remedy is attainable.

RAO 2 for arsenic: The main difference between EW and LDW PRGs is the method used to calculate natural background. Natural background using the 90/90UTL metric is 11 mg/kg, compared to 7 mg/kg using the 95UCL. The target RAL of 57 mg/kg is expected to result in a post-remedy SWAC of 12 mg/kg. Staying consistent with SCUM II and using a PRG calculated using the 90/90UTL ensures the arsenic remedy is more attainable.

RAO 2 for cPAH: PRGs for cPAH are similar between the EW and LDW. The clamming PRG of 150 ug TEQ/kg for the EW is equal to the clamming scenario PRG from the LDW, while a separate beach exposure scenario PRG from the LDW is 90 ug TEQ/kg. The RALs also differ between the EW and LDW. RALs are variable between the EW and LDW. The RAL for the LDW is 1,000 ug TEQ/kg. The RALs for intertidal and subtidal sediments in the EW are 660 and 4,800 ug TEQ/kg, respectively.

RAO 3 for benthic protection: Both the EW and LDW use the SQS sediment criteria for the PRG. The two studies differ in the number of COCs that are modeled as part of the expected remedy. In the EW, 29 COCs have concentrations that exceed the SQS. Eight of these COCs were selected as drivers of the remedy while the other 21 are included in the footprint. In the LDW, 41 COCs have concentrations that exceed the SQS, and all of them included in the proposed remedy. The RALs are also set at the SQS, although select areas in the LDW allow for RALs as high as two times the SQS.

RAO 4 for eco-risk protection: PRGs differed between the EW and LDW due to a difference in impacted species (English sole/rockfish compared to river otter, respectively). RALs associated with RAO 1 are inclusive of the eco-risk PRGs.

The RALs proposed in Table 1 are the remedy drivers. The remedial technologies proposed for the EW alternatives are:

- Dredging;
- Partial dredge and cap; and
- Enhanced natural recovery (ENR).

Lower ranked alternatives include limited ENR in the vicinity of the sill. Higher ranked remedy alternatives are more limited to dredging.

The LDW includes the same remedies listed above, plus two categories of monitored natural recovery. The final alternative selected in the LDW ROD is a mix of all remedies with dredging representing a smaller relative share of the total.

Table [SEQ Table * ARABIC]. Comparison of EW and LDW PRGs and RALs.

RAO	COC	Units	East Waterway		Lower Duwamish Waterway	
			PRG	RAL	PRG	ROD RAL
1	Total PCBs	ug/kg DW	2[a] or 3.5[b]	--	2[a]	--
		mg/kg OC	--	7.5[h,o] or 12[g,o]	--	12[g,p,q]
	Arsenic	mg/kg DW	--	--	both As and cPAH have RALs but no listed PRGs.	
	cPAH	ug TEQ/kg DW	--	--		
	Dioxin (intertidal)	ng TEQ/kg DW	2[a] or 5[c]	25[i,o]	2[a]	25[p] or 28[q]
	Dioxin (subtidal)		2[a] or 5[c]	25[i,o]	2[a]	25[p,q]
2	Total PCBs (intertidal)	ug/kg DW	--	--	500[k] to 1,700[l]	--
		mg/kg OC	--	--	--	12[g,p] or 65[q]
	Total PCBs (subtidal)	ug/kg DW	--	--	1,300[m]	--
		mg/kg OC	--	--	--	12[g,p] or 195[q]
	Arsenic (intertidal)	mg/kg DW	7[a] or 11[b]	57[g]	7[a]	57[g,p] or 28[q]
	Arsenic (subtidal)		7[a] or 11[b]	57[g,o]	7[a]	57[g,p,q]
	cPAH (intertidal)	ug TEQ/kg DW	150[d]	660[j]	90[k] to 150[l]	1,000[p] to 900[q]
	cPAH (subtidal)		380[e]	4,800[j,o]	380[m]	1,000[p,q]
	Dioxin (intertidal)	ng TEQ/kg DW	--	--	13[k] to 28[l]	25[p] or 28[q]
	Dioxin (subtidal)		--	--	37[m]	25[p,q]
3	9 of 29 COCs	mixed	SQS	SQS[o]	--	--
	41 COCs		--	--	SQS	SQS to 2xSQS
	TBT	mg/kg OC	7.5[o]	7.5[o]	--	--
4	Total PCBs	ug/kg DW	250 to 370[f]	7.5[h,o] to 12[g,o]	128[n] to 159[n]	--[r]

Table Notes:

a. natural background calculated using the 95UCL

k. clamming areas

b. natural background calculated using the 90/90UTL
c. PQL of dioxin/furan TEQ
d. tribal clamming RBTC
e. netfishing RBTC

f. protective of English sole and brown rockfish
g. matches PRG for benthic risk, consistent with LDW ROD
h. selected to evaluate the effect of a lower RAL
i. consistent with the LDW ROD
j. achieves PRGs
l. individual beaches
m. site-wide
n. protective of river otter
o. includes surface (0-10cm) and shallow subsurface (0-2ft)
p. surface (0-10cm)
q. shallow subsurface (0-1.5ft or 0-2ft)
r. addressed by lower RALs from RAOs 1-3

1.3 DCA of Alternatives

The detailed cost estimate for FS remedial alternatives is provided in FS Appendix E, including unit costs for individual line items. These costs were based on similar feasibility studies and recent construction bids for sediment remediation projects in the Pacific Northwest. NewFields reviewed these line item costs and found them to be consistent with those used for both the LDW and Portland Harbor feasibility studies.

The cost-effectiveness of FS remedial alternatives was evaluated using CERCLA comparative analysis methods only, and not those of MTCA DCA (see FS Section 10). This differs from the LDW FS, where both a CERCLA comparative analysis and MTCA DCA were performed because the LDW FS was conducted under a joint CERCLA and MTCA order (AECOM 2012). Despite the lack of DCA in the FS, many similarities between CERCLA and MTCA evaluation criteria would likely yield similar cost-effectiveness results. The CERCLA criteria used for EW OU remedy evaluation, as well as those used for DCA, are provided in Table 2.

CERCLA comparative analysis and DCA are similar in that they both compare remedial alternatives using summary data for each alternative, such as the predicted risks resulting from contamination following remediation, the amount of time to achieve cleanup levels, the volume of contaminated sediment removed, and construction timeframe. Unlike the CERCLA comparative analysis, DCA converts evaluation criteria into numerical scores that are weighted based on relative benefit (e.g., the long-term effectiveness metric receives a 30% weighting, while technical implementability only receives 5% weighting [AECOM 2012]). After weighting the criteria, an integrated DCA "total benefit score" is summed for each alternative. These total benefit scores can then be compared to costs as a means of evaluating the cost-effectiveness of different alternatives.

The CERCLA comparative analysis performed for the FS does not derive an evaluation criteria summary metric for evaluating remedial alternative cost-effectiveness. Instead, the cost-effectiveness of FS alternatives can be assessed graphically by inspection of the figures provided in FS Section 11. FS Figure 11-1 provides relative rankings of alternatives based on the CERCLA comparative analysis criteria. Long-term and short-term effectiveness metrics are depicted along with costs for each alternative in FS Figure 11-4. In this figure it is apparent that

Table [SEQ Table * ARABIC]. CERCLA and MTCA alternative evaluation criteria (from AECOM 2012)

CERCLA		MTCA	
Type	Criteria	Type	Criteria
Threshold	Overall protection of human health and the environment	*Threshold*	Protect human health and the environment
			Comply with cleanup standards
	Compliance with ARARs		Comply with applicable state and federal laws
			Provide for compliance monitoring
Balancing	Long-term effectiveness and permanence	*Other Requirements*	Use permanent solutions to the maximum extent practicable[a]
	Reduction in toxicity, mobility, or volume through treatment		
	Short-term effectiveness		Provide for a reasonable restoration time frame[b]
	Implementability		
	Cost		
Modifying	State/Tribal acceptance		Consider public concerns
	Community acceptance		

Notes:

a. The MTCA requirement to "use permanent solutions to the maximum extent practicable" is evaluated using a disproportionate cost analysis that compares the alternatives against the following criteria:
   1. Protectiveness
   2. Permanence
   3. Cost
   4. Effectiveness over the long term
   5. Management of short term risks
   6. Technical and administrative implementability
   7. Consideration of public concerns.

b. The MTCA requirement to determine whether a cleanup action provides for a reasonable restoration time frame considers the following factors:
   1. Potential risks posed by the site to human health and the environment.
   2. Practicability of achieving a shorter restoration time frame.
   3. Current use of the site, surrounding areas, and associated resources that are, or may be, affected by releases from the site.
   4. Likely effectiveness and reliability of institutional controls.
   5. Potential future use of the site, surrounding areas and associated resources that are, or may be, affected by releases from the site.
   6. Ability to control and monitor migration of hazardous substances from the site.
   7. Toxicity of hazardous substances at the site.
   8. Natural processes that reduce concentrations of hazardous substances and have been documented to occur at the site or under similar site conditions.

all alternatives other than No Action, 1A(12), and 3E(7.5) have similar overall effectiveness and costs. The similar effectiveness of many alternatives is reinforced by FS Figure 11-5, where the range of best estimate predicted Total PCB SWACs is small for all alternatives other than No Action and 1A(12).

The information provided in FS Section 10 and Section 11 figures suggests that all alternatives other than No Action and 1A(12) would receive similar total benefit scores based on MTCA DCA. Additionally, alternative 3E(7.5) would rank low for cost-effectiveness based on its highest cost without additional effectiveness. Based on DCA, the remaining alternatives would likely provide similar cost-effectiveness, with the most cost effective result would be determined by the potentially different rankings assigned for technical implementability.

1.4 Conclusions

Based on this review of the *East Waterway Operable Unit – Draft Final Feasibility Study*, we conclude that SMS guidance was correctly followed for the development of all SCL/PRGs. Based on the assumptions provided in the FS, the proposed remedial action alternatives are expected to achieve SMS SCLs for all RAOs following construction, with a single exception. None of the proposed remedial alternatives are expected to comply with the SMS SCL for surface sediment PCBs for RAO 1, which is equal to natural background (Total PCBs = 3.5 μg/kg). Despite this, compliance with SMS has the potential to be attained through Ecology's establishment of regional background for the EW, establishment of SRZs and subsequent monitoring, or a TI waiver. More specific comments primarily related to the language used for the presentation of the SMS rule in the EW FS are presented in the specific comments below.

The PRGs and RALs determined for the EW are mostly consistent with those of the LDW. Differences exist in the method used to calculate natural background for PCBs and arsenic. For dioxins, the PQL is higher than natural background and represents the upper end PRG. Using guidance from SCUM II (90/90UCL for calculation of natural background and a comparison to the PQL) results in more attainable PRGs for dioxins and arsenic.

Unlike the LDW FS, MTCA DCA was not performed for the EW OU FS. Instead, the cost-effectiveness of remedial alternatives was evaluated using CERCLA comparative analysis methods. The many similarities between CERCLA and MTCA evaluation requirements likely yield similar cost-effectiveness results, with all alternatives other than No Action, 1A(12), and 3E(7.5) having similar overall cost-effectiveness.

2.0 SPECIFIC COMMENTS

2.1 Executive Summary

Page iii:

- Recommend adding list of appendices, or some discussion of the individual studies that were performed.

Page 1, General Comment:

- Executive summary discussion moves into remedial alternatives without firmly identifying potential exposure pathways (i.e., clamming areas, surface sediment, and subsurface sediments) in "Contaminant Risks" Section.

Page 1, Site Description, Second Paragraph:

- These tides represent the extremes; values should also be presented for average tides.

Page 1, Purpose, Third Bullet:

- This discussion should explain that sediment contamination is the focus, supporting next section (Contaminants of Concern) declaration that primary COCs are in sediment.

Page 3, Cleanup Alternatives:

- Combined dredging/capping alternatives to maintain bed elevations are commonplace and should be mentioned here and are acceptable where navigation depths must be maintained. ENR/MNR/in situ treatment approaches do not maintain bed elevations, but may be acceptable where navigation is not of concern (i.e., under piers, clamming areas).
- Figure 3 should show the complete process and indicate by highlight that we are currently in the FS stage

Page 4, Key Definitions, Fifth Bullet:

- Please state what the natural recovery process does, i.e., eliminates chemical exposure so that the benthic community can repopulate the remediation area.

5, Commercial and Navigation Activities:

- Figure 3: The figure is not referenced in the text.
- Tribal netfishery is a future use but not shown on the figure.
- Please indicate what the authorization depth is (are), and why there are subarea boundaries within the channel
- Many terminals and slips are shown on the figure but their existence and purpose is not mentioned in the text

Page 5, Habitat:

- The 2014 Supplemental RI says wildlife are not abundant/important in EW, but the text here states that EW provides habitat important to various species. Which is correct? Are there any marine mammals occupying the study area?
- Please state what type of habitat is that supports salmon/bull trout, and where this is located on the figure.

Page 6, Nature and Extent:

- In the first bullet, please further define “hot-spot” in text, and reference Figure 4. While there may/not be active source areas, there are noted areas >1800 ug/kg in the EW sediments which appear to be statistically significant (i.e., > 95th percentile).
- The second bullet does not specifically state that the SWAC includes only surface sediment data from the BAZ. Perhaps footnote 3 should be affixed here.
- In the fourth bullet, please provide 95th percentile for depths of sediments exceeding the SQS, as done previously for surface sediments.

Page 7, Figure 5:

- Clarify Figure title by adding “marine” before “Benthic”. The text describes SMS as applicable to marine benthic criteria.

Page 8, Cover Photo:

- The photo implies hook and line fishing is a significant exposure pathway yet the text describes only net fishing and clamming with minimal reference to hook and line as important exposure pathways. Please select a photo for clamming or netfishing to correct the apparent contradiction.

Page 8, Risk Assessment, First Bullet:

- Indicate the list of analytes included in calculating cPAH.

Page 8, Risk Assessment, Second Bullet:

- Please describe the fish/shellfish species and range of tissue concentrations associated included as "seafood."
- It should be explained that dermal and incidental ingestion exposures to sediment associated with seafood as opposed to tissue consumption of the seafood tissue itself is a significant pathway.

Page 8, Risk Assessment, Seafood Consumption:

- Please describe the source of exposure being evaluated, e.g., clams only or mix species?

Page 9, Risk Assessment, Third Bullet:

- Previously, risks were determined by comparison to SMS; please explain how/where criteria for fish tissue were derived. Also, salmon were determined non-resident species - what evidence exists on home range of sole or rock fish?

Page 10, Figure 6:

- Insert "site" in the caption for Figure 6 Conceptual Model… to be consistent in terminology.
- The ES has not addressed sheet flow or seeps as possible sources of COCs. The figure may need to be revised accordingly.

Page 10, Physical and Chemical Modeling, First Paragraph:

- Please provide the reader the reason for the investigation - i.e., majority of chemicals are bound to sediments.
- In the first bullet, "on average" suggests half of the locations indicate net depositional conditions. However, the text indicates that a "majority" of cores were net depositional. Please clarify.
- In the second bullet, there appears to be 2 sets of modeling results presented here: one where scouring ranges 0.5-5 ft and another being > 2 ft with conditions being the same. Please provide reason and importance for differences in model predictions.

Page 10, Sedimentation in the EW, First Bullet:

- In the first bullet, given 99% volume of clean sediment going into the EW and lack of ongoing COPC sources, please explain why have local hot spots remained despite significant dilution processes? Similarly, how have lateral gradients in COPCs been maintained given these conditions?

- In the second bullet, please discuss whether sheet flow or seeps from upland sources in addition to SOs and CSOs are contaminant sources.

Page 11, First Bullet:

- Please describe what chemistry changes over time have been observed to the extent that additional modeling was needed.

Page 11, Fourth Sub-bullet:

- Has it been determined on a case-by-case basis which locations are CSO impacted?

Page 11, Footnote:

- Please note that dredge residuals also include the newly exposed sediment concentrations at the new sediment -surface water interface.

Page 13, Table 1:

- Please note how total PCB is calculated, i.e., sum congeners, Aroclors, etc.
- Please footnote TBT entry as the Organic Carbon normalization step requires explanation.
- Please add a note explaining TEQ (Toxicity Equivalency Quotient) as this is first use.
- Revise acronym to read "Toxicity Equivalency Quotient."

Page 14, Figure 7:

- Clamming areas locations indicated in Figure 3 and Figure 7 don't appear to match.

Page 14, Remedial Action Levels and Remediation Areas, Third Paragraph:

- Please indicate in Figure 7 where propeller scour deeper than 10 cm will occur and how deep the disturbance can extend.

Page 15, Table 2, RAO1

The regional background has not been established at EW, how would you expect that RALs for PCBs and dioxins/furans are expected to meet an unestablished number?

Page 16, Evaluation and Screening of Remedial Technologies:

- In the second bullet, please note whether consideration was given to the habitat quality of the engineered cap.
- In the third bullet, sill areas have not been described or identified. Please provide.
- In the fourth bullet, please explain that benthic communities under piers are at risk and thus require sediment in situ treatment.
- In the fifth bullet, if the human health risk driver was incidental sediment contact not tissue consumption, this may be an inappropriate example and may require revision.

Page 19, Remedial Alternatives, First Bullet:

- In the first bullet, please describe depth of dredging for various alternatives (in this case 6.6 ft) relative to vertical contaminant distribution for this alternative. Given area and cy, average dredge depth can be determined:

  77 acres = 372680 sq yd * 2.20 (6.6 ft) yd deep = 820,000 cy

Page 19, Remedial Alternatives, Fifth Bullet:

- It is not clear what "maximum removal" implies here. Please explain. It is presumed that all alternatives will strive to dredge deep enough to eliminate the surface sediment and subsurface sediments at risk to propeller scour exposures.
- Please describe depth of dredging (in this case 5.95 ft) relative to vertical contaminant distribution for this alternative. Given area and cy, average dredge depth can be determined:

  100 acres = 484000 sq yd * 1.98 (5.95 ft) yd deep = 960,000 cy

Page 19, Remedial Alternatives, Sixth Bullet:

- The need to evaluate the 7.5 mg/kg RAL has not been explained (not included as a PRG in Table 1).

Page 20, Figure 9:

- Proposed dredge depths all average about 6 ft, although each alternative requires a significant difference in dredging volume. Please discuss the proposed neat line required for constructability.

Page 22, Table 4:

- The volume removed for Alternative 3, 5, 7 and 9 is different from what is shown in Figure 9 on Page 20.

2.2 Main Text: Part 1 (Sections 1-2):

Section 1, Introduction, Page 1-2:

- This is a short list and doesn't include many guidance documents (e.g., capping and MNR were used and cited in individual Appendices). This is not the place to list these documents, but suggest it is said that "many guidance documents were referenced, including the following:"

Section 1.2, Purpose of the Feasibility Study, Page 1-3, Paragraph 2:

- These "potential sources and pathways" are depicted in the CSM for the site; was the 2014 report the source of the CSM? If so, suggest it is explicitly stated this is the case. It is never said what the sources of contamination are, only transport and fate processes involved.

Section 1.3, The Feasibility Study Process, Page 1-3, Paragraph 1:

- It would be useful to reference the appendices directly after each bullet.

Section 1.3, The Feasibility Study Process, Page 1-4, Paragraph 2:

- Note ")" typo after ROD to be deleted.

Section 1.4.1, Regulatory Terms, Background, Page 1-5, Paragraph 2:

- It is confusing to introduce SMS here. Suggest follow-on text be deleted/moved to a new standalone SMS definition. Second sentence does not read well and requires revision.

Section 1.4.1, Regulatory Terms, Total excess cancer risk, Page 1-8, Paragraph 1:

- "For example…." While the statement is accurate, specific exposure pathways for this FS have not yet been presented in the FS, such that the statement is premature (CSM has not been presented).

Section 1.4.2, Sediment Concentrations, Page 1-8, Paragraph 2:

- Please add clarification that point concentrations are presented as dry wt and organic carbon normalized values.

Section 1.4.3, Terms Related to Time Frames, Page 1-10, Paragraph 2:

- Specify whether this construction period is for this site, or is a requirement for all sites.
- Please clarify that "This remedial technology" is for a selected remedial alternative, including 1 or more technologies as required.
- Clarify that "contingency actions" may involve modification of the technology or methods of application.
- "This FS makes a distinction"; the terms have different usages and should be separately defined. Is there monitoring involved in the natural recovery period? Please clarify in the definition.

Section 2.1, Environmental Setting, Page 2-2:

- Clarify whether (Figure 2-1) station markers are the sediment sample locations, Paragraph 1?
- Please describe the Sill reach environment - is this a bathymetric distinction, Paragraph 2?

Section 2.2, Site History and Current Configuration, Page 2-2, Paragraph 3:

- Where were the dredged sediments generated to create the current channel disposed of?

Section 2.3, Bathymetry, Page 2-4, Paragraph 2:

- Please add any observation on location/magnitude of depth change from earlier bathymetry studies to present?

Section 2.6, Sediment Characteristics and Stratigraphy, Page 2-6, Paragraph 1:

- Please explain the reason for this pattern (i.e., past dredging).

Section 2.6.2, Stratigraphy, Page 2-7, Paragraph 3:

- "A hydrogen sulfide odor was common in the sample". This is unexpected given the low TOC; can some explanation be provided?

Section 2.6.2, Stratigraphy, Page 2-9, Paragraph 1:

- Please replace "as a result of" with "based on observations of".

Section 2.7, Hydrogeology, Page 2-9, Third Bullet:

- Are these evidence of seeps?

Section 2.9.2, Navigation and Berthing, Page 2-12 Paragraph 1:

- While "call" may be nautically correct, "dock" or "berth" may be more understandable.

Section 2.9.2, Navigation and Berthing, Page 2-13 Paragraph 4:

- This section is a significant break from facilities description and might be considered as a separate numbered section.

Section 2.9.3, Tribal and Recreational Use, Page 2-14 Paragraph 3:

- This is a fairly restricted area for HHRA as compared to the benthic environment impact area. This should be amplified in the risk assessment sections.
- Is this a significant area for sediment exposure?

Section 2.9.4.1, Habitat Types, Page 2-15 Paragraph 1:

- "There are no remaining tidal marsh…" This statement seems to contradict clamming as a significant risk/remediation driver.

Section 2.9.4.1, Habitat Types, Page 2-16 Bullet 1:

- Please indicate whether the area been mitigated for chemical contamination.

Section 2.9.4.2, Biological Communities, Page 2-17 Paragraph 2:

- What abundance of clams or habitat exists for these species, given the previous statement that mudflat habitat is limited?

Section 2.9.4.2, Biological Communities, Page 2-17 Paragraph 3:

- Indicate where there are any feeding habitats in the EW for these species.

Section 2.10.2, Subsurface Sediment, Page 2-20:

- "that were ultimately not dredged" What does this mean - will not be dredged?

Section 2.10.3, Phase I Dredge Area, Page 2-20 Paragraph 3:

- Please quantify what the deposition rate was.

Section 2.10.3, Phase I Dredge Area, Page 2-21 Paragraph 1:

- Please confirm these results were used to assess remediation methodologies later on in the FS.

Section 2.11.3.2, Potential Ongoing Source Pathways, Page 2-37 Bullet 2:

- Tidal pumping causing groundwater discharge/seep generation should be explicitly included/addressed in the CSM.

Section 2.11.3.2, Potential Ongoing Source Pathways, Direct Discharge, Page 2-39:

- See previous comment: Lateral discharge could include seepage and should be explicitly stated.

Section 2.11.3.2, Potential Ongoing Source Pathways, Groundwater Discharge, Page 2-39:

- Text indicates "extensive groundwater and seep information is available" but following text only discusses groundwater results. Please summarize the seep sample results.

Section 2.11.3.2, Potential Ongoing Source Pathways, Groundwater Discharge, Page 2-40:

- Groundwater monitoring should resume at both USCG and T-25 due to exceedence of contaminants in both groundwater and sediment. If data indicates that groundwater is an ongoing source for sediment contamination, source control should be conducted.

Section 2.13, Key Observations and Findings from the SRI, Page 2-48:

- Additional potential key observation to be addressed: Is PCB is an ongoing source and/or are there multiple sources? Has chemical fingerprinting been performed to determine whether unique sources exist?

Section 2.13, Key Observations and Findings from the SRI, Page 2-49:

- Another bullet should be added in this section to brief sub-surface sediment conditions.

2.3 Main Text: Part 3 (Sections 3-12):

Figure 3-1, East Waterway HHRA Direct Sediment Exposure Areas, Page 3-38:

- It is not clear how clamming areas were identified - water depth, substratum site use, other?

Section 4.2.1, Remedial Action Objectives for the East Waterway Operable Unit, RAO 1, Page 4-7:

- It should be pointed out that HI>1 "generally" warrant response action, but the HI includes both background plus site-specific exposure, so achieving HI< 1 may not be possible.

Section 4.2.1, Page 4-7, 2nd full paragraph:

- To be more consistent with the SMS rule, this should state that the SMS target for the SCO is a RBTC risk of no greater than 1×10^{-6}, and the target for the CSL is a RBTC risk of no greater than 1×10^{-5}.

Section 4.3.1, 2nd full paragraph of Section 4.3.1, Page 4-14:

- The text says "Under the SMS, *sediment cleanup standards* may be established…" The nomenclature would be more in line with SMS to call the sediment cleanup standards by their correct name of sediment cleanup level (SCL).
- Later in the same paragraph "The *cleanup level* may be adjusted…" Use SCL instead.
- The relationship between the SCL and PRG could be made clearer in the text. Perhaps the end of this same paragraph could be adjusted to state "The SCO is the higher of the risk-based levels ($1x10^{-6}$), PQLs, and natural background. The CSL is the higher of the risk-based levels ($1x10^{-5}$), PQLs, and regional background. The SCL is originally set at the SCO, but may be adjusted upward to the CSL. As such, the SCL in SMS is equivalent to the PRG in CERCLA."
- Appendix A does a better job of discussing this using language from the WAC.

<u>Section 4.2.1, Page 4-8, Paragraph 2</u>:

- "Anadromous fish are not included" (i.e., salmon); do any other named receptors also fall into this category?

<u>Section 4.2.1, Page 4-10 Paragraph 1</u>:

- Indicate that earthquakes could increase exposure by mixing/liquefaction of surface and subsurface sediments

<u>Section 4.2.2, Role of Source Control, Page 4-12, Paragraph 3</u>:

- Please reference section where source control activities for PCBs being considered are discussed.
- Please note that transport and fate (distribution and depth) of current PCBs as the key risk driver has not been explained and may be a major impediment to achieving RAOs.

<u>Section 4.3.1, Role of ARARs, Page 4-15, Paragraph 2</u>:

- This paragraph about natural background would make more sense following a discussion of RAO 1.
- Natural background is the default in areas where regional background has not been determined, assuming it is higher than the PQL, or risk based concentration.

<u>Section 4.3.1, Page 4-15 Paragraph 3</u>:

- Although regional background is not separately evaluated it is inherently included in the total exposure estimate.

<u>Section 4.3.2, Role of RBTCs, 2nd full paragraph, Page 4-17</u>:

- "Sediment RBTCs for total PCBS were calculated for the $1x10^{-4}$ excess cancer risk…" If following SMS, this shouldn't exceed $1x10^{-5}$ for the CSL. Ultimately it doesn't matter as the RBTC is below natural background.

<u>Section 4.3.3.1, Natural Background in Sediment, Pages 4-20 through 4-23</u>:

- A lot of effort is put into explaining the different statistics (and data sets) used to calculate natural background for the LDW FS and in SCUM II. This results in text and tables listing two separate values for natural background. Keeping just the NB values from SCUM II (90/90 UTL calculated with Bold Plus) would be most consistent with Ecology's SMS rule.
- A similar comment is presented in the comment response table, but the resolution is unclear.

Section 4.3.3.1, Natural Background in Sediment, Natural Background for cPAHs in Sediment, Page 4-22:

- Briefly describe what 90/90 UTL means.

Section 5.1, Overview of Sediment Transport in the East Waterway, Page 5-3 Paragraph 2:

- Please indicate whether high flow periods could be part of observed episodic mixing
- Only areas near the pier edge should be subjected to prop wash erosion? What does the Cs137 peak relative to core location indicate in this regard, (it isn't possible to see where the cores were taken in relation to the pier edge).

Section 5.3.1, Chemistry Assumptions for Upstream and East Waterway Lateral Sources, Page 5-17:

- Section 2.11.3.2 notes seeps as a possible lateral source of COCs. Please address why seeps are not addressed here. What about lateral sources from erosion of underpier sediments by scour?

Section 5.3.4, Exchange of Open-water and Underpier Sediments, Page 5-26 Paragraph 2:

- The figure estimate doesn't include the lateral distance and depth of disturbance (i.e., volume of sediments).

Section 5.3.5, Percent Reduction in Bioavailability of Hydrophobic Organic Contaminants Due to In Situ Treatment, Page 5-27:

- It is not clear what this 90% figure represents – reductions observed in other studies? Please provide a reference for this value.

Section 5.3.7, Area-specific SWAC, Page 5-30:

- May be first use of this acronym, and would need some explanation.

Section 5.3.8, Sensitivity and Bounding Evaluations, Page 5-30:

- The text discusses the same Alternative 2B(12) as having either ENR and in situ treatment for Underpier areas? Please clarify.

Section 5.6.3, Recontamination Potential Evaluation, Page 5-45:

- As mentioned in Section 2.11.3.2, underpier sources, i.e., seeps, sheet flow, etc., extend the area of concern to the entire boundary of the EW Operable Unit, and not restricted to the SO only. Potential loading should be estimated for the entire upland OU that drains into the EW.

Figure 5-2, Predicted Scour Depths from Vessel Operations, Page 5-47:

- Scour boundaries shown in the Figure 5-2 do not appear limited in extent toward shore where piers exist and access by prop scour would abate. Data has shown that underpier sediments are stable, thus not scoured.

Section 6.1.2.2, Intertidal Areas, Page 6-5:

- This section describes the method used to merge the composite samples collected from the intertidal areas with the Thiessen polygon interpolation for the subtidal areas. Arsenic and cPAH are the only COCs mentioned. In Section 3.2.2 (Table 3-6) PCBs and dioxins are also mentioned as potential risk drivers for dermal contact (RAO 2). It is unclear from the text, but are dioxin and PCB concentrations interpolated into the intertidal areas using the same methodology used for arsenic and cPAH?

Section 6.2.1, RAO 3 (Protection of Benthic Invertebrates) RAL, Page 6-9:

- LAET has been defined in previous table notes but further description and application here is needed.
- In the first paragraph of this section, SQS benthic criteria are used to evaluate exceedances in the top 10 cm of the sediment. In the second paragraph, TBT exceedances are evaluated in the top 0-2 ft. Would evaluating the SQS criteria in the top 0-2 ft change the area of exceedance?

Figure 6-1, Benthic Risk Drivers, Page 6-15:

- Hash mark pattern for dock/pier in legend doesn't match figure; should slant forward.

Figure 6-3, Areas Above PCB RALs in Surface Sediment and Shallow Subsurface Sediment, Page 6-17:

- This figure combines the RAL exceedances for surface and subsurface sediment. Please revise/add figure to indicate separate exceedances so the potential remediation areas are more clearly defined (i.e., clean surface over contaminated subsurface would not require remediation).

Section 7.2.4, Enhanced Natural Recovery, Page 7-17, First Bullet:

- What is the technical basis for the 9" cap thickness - i.e., steady state value at sediment water interface meeting PRG?

Section 7.2.4, Page 7-17, Second Bullet:

- Same comment as above; 15" may address scour depth but does it control chemical migration?

Section 7.2.5, In Situ Containment (Capping), Page 7-18, Paragraph 2:

- This entire section doesn't appear to address reactive mat capping, only the placement of loose materials. Please add or indicate why it is not applicable.

Section 7.2.5.1, Cap Design, Page 7-19:

- Please add mention of ground water vertical migration which has a very significant effect on the cap design

Section 7.2.5.2, Cap Material Placement, Page 7-20 First Paragraph:

- Please add mention of reactive cap mats, i.e., CETCO, that are designed to work on steep slopes.

Section 7.2.5.3, Elevation Requirements, Page 7-21:

- Please note that depth of over-dredging to accommodate the necessary cap thickness would also depend on the residual un-dredged COC concentration, which would provide the new contaminant source loading the overlying cap.

Section 7.2.5.4, Summary, Page 7-22 First Paragraph:

Please add the following considerations to this section:

- "Because capping disturbs relatively little in situ contaminated sediment." Is not necessarily true and is operator-dependent (among other factors).
- Capping where predredging might be required for no net loss of navigation depth is a significant source of disturbance.
- Capping may also require a habitat enhancement layer to accelerate recolonization of benthic community.
- Placement of cap material as overburden may have the effect of compressing underlying sediment layers and "squeeze" porewater from depth into the overlying cap and water column.

Section 7.2.6, Removal, Page 7-23:

Please add the following considerations to this section:

- Impacts on fish tissue concentrations can occur well downstream of the dredging action (e.g., GE Hudson).
- Turbidity plume control may still be required but difficult to implement in the deep and high current EW waters.

Section 7.2.6.1, Mechanical Dredging, Page 7-23:

- Please note that environmental buckets may be used to limit sediment resuspension during retrieval of sediment through the water column.

Section 7.2.6.1, Mechanical Dredging, Page 7-24:

Add notes that:

- barge dewatering may be subject to treatment if concentrations are shown to exceed WQC.
- Positional control technology/differences of the fixed vs. cable arm methods should be discussed.

Section 7.2.6.5, Dredge Residuals, Page 7-27:

- Clarify that reducing the failure to delineate and dredge missed inventory must be addressed in the sampling conducted for the remedial design.

Section 7.2.6.5, Dredge Residuals, Page 7-28:

Add notes that:

- Placement of the RMC may be subject to resuspension and uncontrolled dispersion.
- In addition to cost, the relatively coarse nature of the sediment would minimize dispersion during RMC placement.

Section 7.2.7.1, In Situ Treatment, Page 7-30:

- Note that reactive material placement within geotextile layers, and with multiple reactive agents (i.e., apatite, AC, organoclay), has been successful.

Section 7.2.7.1, In Situ Treatment Effectiveness Assumptions, Page 7-31:

More discussion of the 70% reduction efficiency specifically for the EW site is recommended, addressing the sediment COCs and concentrations involved and resulting biota tissue values..

Section 7.3.3, Beneficial Use, Page 7-40:

- Discuss whether much of EW sediments qualify for beneficial uses\daily landfill cover. Also discuss whether there are opportunities to use dredged sediments as possible base material for wetlands creation.

Section 7.8.2, Underpier Areas, Page 7-63, Last Paragraph:

- Consider reactive mat cap may be a viable technology here.

Section 8.1.1.2, Pile and Debris Removal, Page 8-3:

- What observations of debris have been made for under pier areas?
- Is there any concern over pier stability by dredging too close to the pier?

Section 8.1.1.3, Transloading and Upland Disposal, Page 8-3:

- Additional issues surround barge filling and transport may include odor, noise, navigation restrictions, and many others, and need to be addressed.

Section 8.1.1.4, Water Management, Page 8-4:

- Sediment effluents will contain PCBs; will a release of PCBs to the water body be allowed? Other sites regulated under NPDES agreements have not allowed any releases. Not allowing barge dewatering at the dredge site would significantly impact production. Please discuss.

Section 8.1.1.5, Sea Level Rise, Page 8-5:

- These predictions have changed/accelerated over last decade - please update the projections if possible. Area/viability of mudflats for clamming will be greatly affected by sea level rise and thus will not affect all alternatives equally.

Section 8.1.1.6, Dredge Area and Volume Estimates, Page 8-5:

- Please summarize what the neatline dredge depths are for each area. What uncertainty (e.g., 95th percentile of depth range) is allowed to address minimization of missed inventory?

Section 8.1.1.6, Page 8-6, Paragraph 1:

- See previous comment - while polygons can accurately depict sediment areas, it is not constructible. Also what is the assumed neat line depth of contaminated sediments in intertidal areas?

Section 8.1.1.6, Page 8-6, Paragraph 2:

- The TIN is not a constructible boundary; some methods of smoothing/averaging are going to be required.

Section 8.1.1.6, Page 8-6, Paragraph 3:

- Dredging only to 5ft for cap placement will not allow and over dredge allowance.

Section 8.1.1.6, Page 8-6, Paragraph 4:

- Existing bathymetry already shows a depression where the cable crosses the EW, such that pre-dredging may not be required. Has a sub-bottom sonar survey been completed of the cable areas as well as the toe of slope for riprap areas to determine current burial depth?

Section 8.1.1.6, Page 8-6, Paragraph 5:

- These jet probe data have not been previously mentioned. Please discuss the study and results (in appendix?) and summarize here. Revise "and jet probe data" to "using jet probe data".
- How was it determined if riprap contained soft sediments or not? If present, hydraulic dredging would remove sediments and would be a significant volume when extrapolated over the entire site.

Section 8.1.1.7, Material Placement Volume Estimates, Page 8-7, Paragraph 1:

- What is the technical basis for assuming 9" of residual management cover; for use of RMC at all?
- Indicate that the backfill volume is the same as the in-place dredging volume, less bulking factor.
- Also, might dredging adjacent to cable line not be allowed over concerns of destabilization (same as for toe of slope for riprap areas)?
- Clarify that 18 inches is the expected maximum depth of prop wash scour.

Section 8.1.1.7, Page 8-8:

- If the BAZ is 10 cm, explain why is 3" cap considered protective?

Section 8.1.1.8, Construction Timeframe, Page 8-8:

- Clarify that the fish window applies to the EW OU.
- This is first use of windows concept; explain why this time restriction is being applied. Also could some areas such as slips be partially exempt (activity specific) if area use for fish migration/spawning could be prevented or assumed to be negligible?

Section 8.1.2.1, Removal, Mechanical Dredging, Page 8-9:

- Please indicate barge capacity, number of barges, and approximate turn-around time.

Section 8.1.2.1, Page 8-10:

- Per previous comment, a sub-bottom survey indicating toe of slope location would help reduce this uncertainty.

Section 8.1.2.1, Driver-assisted Hydraulic Dredging Under Piers, Page 8-10, Paragraph 1:

- Note that there are also significant mobilization costs, including separate safety plans and check-out dives to demonstrate competency and feasibility of technical approach.

Section 8.1.2.1, Dredge Residuals Management, Page 8-11, Paragraph 1:

- Note that the residuals include the undredged material not meeting RALs.

Section 8.1.2.1, Page 8-11, Paragraph 2:

- Indicate that the actual RMC area will be determined by monitoring conducted during the post-dredging phase.
- Note that the RMC layer would act as a habitat enhancement layer.

Section 8.1.2.2, Partial Dredging and Isolation Capping, Page 8-12, Paragraph 1:

- Note that residuals management using RMC is unnecessary since a cap will be applied.

Section 8.1.2.3, In Situ Treatment, Page 8-13, Paragraph 1:

- Please see previous comment requesting explanation as to why 3" treatment with AC is sufficient.

Section 8.1.2.3, Page 8-13, Paragraph 2:

- Please quantify what % reduction was assumed for economy of scale.

Section 8.1.2.3, Page 8-13, Paragraph 3:

- Please specify total potential acreage of underpier areas.
- Please indicate how this 2.3-ft average neatline depth is calculated (i.e. average of minimum and maximum depths).
- "(costs" . Remove parenthesis and begin new sentence.

Section 8.1.2.4, Enhanced Natural Recovery, Page 8-14:

- Please restate that allowance for overdredge may be required to ensure underlying cap is not disturbed.

Section 8.1.2.5, Monitored Natural Recovery, Page 8-15:

- Please state what the potential exchange rates are (e.g., cy/yr) and how they relate to contaminant concentrations over time - is this process of scouring/mixing eventually diluting the under pier sediment concentrations?

Table 8-2, Limited Access Area Technology Options, Page 8-23:

- Explain why removal only is satisfactory for PCBs but PAHs can be addressed by in situ treatment?

Section 9, Detailed Analysis of Alternatives:

- No comments.

Section 10, CERCLA Comparative Analysis:

- No comments.

Section 11, Conclusions:

- No comments.

Section 12, References:

- No comments.

2.4 Appendices

Appendix A, Section 4

- A technicality, but the rules for upward adjustment of the SCL described in Section 4 only apply to upward adjustments that remain below the CSL (Section iii of the WAC code). It's really at this point that the PRG deviates from SMS.

Appendix A, Part 1, Section 4.3, Summary and Conclusions, Page 16, Paragraph 2:

- This statement indicates that "when considering all these areas together" achievable PCBs cleanup levels (site-wide SWAC) is 57 ug/g dw when considering areas near structures. This value is much lower than that reported as "achievable concentrations for all lines of evidence" of 153 ug/kg dw (Page16 Paragraph 3). Please clarify the apparent discrepancy.

Appendix B, Part 1, Section 2, Overview of Initial Modeling Approach, Page 3:

- Waves due to ship wake may reflect off riprap or otherwise be trapped under piers to significantly magnify the potential erosional sources ("currents due to ships"). This scenario was apparently not addressed due to PTM model limitations. How important could this transport pathway be?

Appendix B, Part 1, Section 3.3, Comparison of Current and Future (Source Control) East Waterway Laterals Solids Input, Page 9:

- Should this be "lateral"?
- Although seemingly obvious to most, the term "lateral" should be defined (i.e., "points of potential release entering the EW along the length of the channel").

Appendix B, Part 3A, Section 2.1.3, Estimating the Residual Layer Thickness Concentration, Page 6:

- Please expand (with references to source) upon impacts to post-construction SWAC values for having 50% loss. Are SWACs of the final residuals limited to one-half of the redredged material concentration? This is significant limitation to one-pass removal, and raises whether second-pass or no-pass/capping is the appropriate approach to address the problem.

Appendix B, Part 3A, Section 3, All Remedial Technology Areas, Page 12:

- How was the 2.3 ft thickness estimate for under pier areas derived? Was depth to rip rap surveys conducted, for example? How does depth uncertainty this impact the estimate?

Appendix B, Part 5, Section 2.1, Types of Dredging Residuals, Page 3:

- Issue of "missed inventory" needs to be highlighted as a key factor to achieving the SWAC goal (apparently relegated as a contingency action).

Appendix B, Part 5, Section 5, Summary and Conclusions, Page 26:

- Please revise reference to Section 2.3, Paragraph 1 for description of "interior unremediated islands".

Appendix C

- It's stated that OC normalized concentrations can't be interpolated using IDW. Why is this?
- The assumption is that TOC and PCBs may not have been collected at the same locations, meaning some samples wouldn't be included in the IDW interpolation.

- If this is the case, the same issue would be a similar problem in the Thiessen method used in Section 6 of the FS.
- It is unclear why not being able to interpolate OC normalized concentrations was a deal-breaker for IDW, but not the Thiessen polygons.

Appendix C, Section 3.1, Sample Density, Page 7:

- Please describe the sampling design that would be employed/suggested to support the remedial design. Also, little description of the subsurface contaminant distribution (by either Thiessen or IDW methods) is provided. What does the neat line look like in light of these present results?

Appendix D, Section 2, Model Selection and Technical Approach, Page 2:

- Please specify what the model is (CapSim, steady state), and the current version (e.g. CapSim v1.12, 2012). Is the BAZ layer mixing included in the model? If not, what mixing rate is assumed?

Appendix D, Section 3, Input Parameters, Page 4:

- Please justify use of average concentrations - is not the contamination layer in contact with the cap typically used as the best source estimate of potential migration?

Appendix D, Tables, Table 2a, Cap Model Results for PCBs:

- This Darcy velocity is not particularly high, being 20X + lower than that used for the intertidal condition. Do uniform groundwater flow conditions exist across the site? Please explain the uncertainty of using the literature values (Fabritz, 1998) versus site-specific data for Darcy velocity.

Appendix D, Tables, Table 3, Koc Values for Select Organic Compounds:

- The selected PAHs exclude lower Koc compounds (i.e., naphthalene, log Koc 3.3), which will greatly increase the prediction of vertical migration and potential break through. This would also apply to specific carcinogenic PCB congeners as well. Please discuss this uncertainty of using high Koc compounds as it relates to potential breakthrough and surface concentrations above the cap..

Appendix D, Attachment 1, Figure, Figure 1-1, Operational Propwash Areas:

- This figure is lacking a legend to explain the boundaries being displayed. Please revise.

Appendix E, Section 2.2, Removal, Page 5:

- Diver-assisted dredging costs are a key factor in the comparison of remedy options. Please provide some detail on costs of other projects. If this is done infrequently, lack of experience should be factored into the cost uncertainty.

Appendix E, Section 4, Summary and Accuracy, Page 11:

- Are costs associated with "weather days" or down time for equipment maintenance and repair captured?
- Are the costs of sampling in support of the remedial design captured?
- Please elaborate how fisheries migration can impact costs beyond the fish windows remobilizations already assumed. Is this possibly related to marine mammal restrictions?

Appendix F, Section 2.4, Dredge Cut Prism Volume Calculation, Page 7:

- What volume contingency is reserved for volumes associated with constructible dredge prisms?
- How often was the maximum depth of RAL exceedance not captured? What effect does this have on the volume uncertainty?
- How does slumping sediment add to the removal volume - would it not simply reduce the volume in the adjacent polygon?
- This constructability factor is presented as a multiplier of sediment volume for remedial volume estimation (and cost estimation). This a major source of uncertainty and requires a more detailed analysis for this site than simply referencing past project experience for validation.

Appendix F, Section 4, Sources of Uncertainty, Page 10:

- Where is this additional 1 ft of contamination assumption presented and how is it justified? If current composite core lengths are 4 ft or greater, contaminated layers could extend 3 ft or more (but masked by blending).

Appendix F, Tables, Table 2, Removal Volumes for Alternatives:

- Please confirm whether an overdredge allowance has been included in the calculation.

Appendix G, Section 6, Long-Term Monitoring, Page 6:

- The original baseline data set was based on 4-ft core composites. Within that layer, individual horizons exceeding the RAL could exist, especially in the BAZ, which could greatly underestimate risks. How will this potential exposure be monitored after the remedy is complete? See also comment above on Appendix F, Section 4, Sources of Uncertainty, Page 10.

Appendix H, Remaining Subsurface Contamination, Section 3 Results:

- This section presents the core results for subsurface sediments but does not discuss the distribution or otherwise present the polygon or DW results to understand the potential distribution. Please add a Results Section and elaborate further on the overall patterns.

Appendix I, Part 2, Section 2.1, Remedial Activities Evaluated, Page 3:

- While air pollution is generically addressed and there is a lack of typical problematic contaminants (i.e., NAPL) presence of hydrogen sulfide has been observed such that there may be a need for an application of odor control technology (e.g., foam cover application) that may/may not be required during the dredging process or rail/truck transport. Please address.

Appendix J, Section 2.2.1, Definition of East Waterway Sub-areas, Page 13:

- The referenced Figure 2 provides an ideal mix of cleanup approaches to address various areas exceeding RAL, but the approach is likely too complex to be constructible. Has further analysis of these maps been performed to produce constructible areas (and associated sediment volume estimates, costs, etc.)?

Appendix J, Section 2.3.2.1, Alternative 1A(12), Page 23:

- Underpier areas are cited as having higher concentration sediments, and lateral exchange of particulates may be a significant source of COPCs to the main channel areas. What information exists as to source characterization, i.e., fingerprinting to assess whether this proposed transport pathway is complete?

Appendix J, Section 2.3.2.2, Alternative 2B(12), Page 24:

- Reduction in bioavailability due to in situ treatment is cited as the most sensitive site performance parameter; 70% reduction is selected as the quantitative response to be achieved. A lack of site-specific direct measurement via treatability studies is a significant data gap. What studies, i.e., (column, field trials, etc.) exist to back up this estimate?

Appendix J, Section 2.3.2.3, Summary, Page 25:

- As noted in the previous comment, chemical source characterization to identify Green River sources versus local sources on total chemical concentrations to be achieved post-construction should be conducted.

Appendix J, Section 3.1, Input Variables, Page 31:

- This section notes that amounts of sediment from different sources vary by point location. What information exists regarding source chemistry, i.e., chemical composition also varies by point location? Please quantify this assumption for use in source control/recontamination
- This section discusses underpier mixing and draws the assumption of fully mixed sediments. Radiological dating of core profiles was performed at many locations and the presence of the Cs137 peak indicates a lack of vertical mixing. Can this information be used to derive more technically supportable estimates of vertical mixing extent?

Appendix J, Section 5.1.4, East Waterway Lateral Solids Inputs, Page 47:

- This section states that catch basin sediments may not be representative of what is discharged through the outfall. Has this uncertainty been evaluated, i.e., whether distinct chemistry sources exist due to local chemical releases reflective of site-specific releases?

Appendix J, Section 5.1.6, Bed Replacement Values, Page 50:

- This section notes that actual undredged sediments that are part of the new surface chemistry may exceed the cleanup goal. Unlike the dredge residuals, the thickness of this layer is unknown and may be a far more significant recontamination source if disturbed than the dredge residuals. Has any analysis of spatial variability been conducted to assess whether this is likely to occur? Lines of evidence would include isolated cores having a deep layer of contamination, and whether distributions (chemical contours) are uniform or sporadic. See comment on Appendix H, Remaining Subsurface Contamination, Section 3, Results.

Appendix K, Direct Atmospheric Deposition Evaluation

- No comments

Appendix L, Section 3.1.2, Effect of Varying Open-water Technology Option, Page 9:

- The text states that dredging is the primary remedial technology because navigational depth requirements. This is incorrect. The purpose of the remedial action is to reduce risks, not to achieve navigational depth goals which are important but not principal to meet RALs. Deeper dredging would reduce propwash forces that may resuspend COCs, hence is a remedial technology for that reason. Please clarify the technology selection goals.

Appendix L, Section 3.2, Implementability Screening Metric, Page 12:

- Has an analysis been performed on disposal costs based on reuse of sediment as daily cover versus solid waste?

- Are there presently disposal sites available with the required capacity and permit to accept such a high volume of material?

Appendix L, Section 3.2, Implementability Screening Metric, Page 13:

- Is sediment removal from riprap surfaces part of or excluded from the underpier remedial action for technology using diver-assisted hydraulic dredging? Figure 3-1 indicates riprap is a no action area.

3.0 REFERENCES

AECOM. 2012. Lower Duwamish Waterway Final Feasibility Study, Seattle, Washington Prepared by AECOM. October 2012.

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Ecology. 2015. Sediment Cleanup Users Manual II. Guidance for Implementing Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC. Publication No. 12-09-057. March 2015.

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